

Capital Flows and Monetary Policy in East Asia

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I. Introduction

In recent years almost all countries in the Pacific Basin have attempted to promote greater economic efficiency by undertaking steps to liberalize their domestic financial systems and remove restrictions on international capital flows. Hong Kong and Singapore have had relatively liberal financial regimes since the 1970s, with interest rates determined in the private sector and foreign exchange controls eliminated. Significant financial reforms have been undertaken in Japan and Malaysia since the late 1970s and in the Philippines, Australia, New Zealand, and Indonesia since the early 1980s. More recent movements toward liberalization have occurred in Thailand, Korea, and Taiwan. Although the timing and the extent of liberalization steps have varied across countries, virtually all countries in the region have allowed domestic and foreign market forces to play a greater role in their financial markets.

As the structure of financial markets has changed, both the conduct and effectiveness of monetary policy in Pacific Basin countries have been affected. The relaxation of interest rate regulations and the expanding range of sources of credit have allowed changes in interest rates to be transmitted more rapidly and pervasively to all sectors of the economy. The increased mobility of international capital has made the balance of payments and the exchange rate increasingly important channels for the transmission of monetary policy. At the same time, increased international capital mobility has reduced the ability of national monetary authorities to conduct domestic monetary and fiscal policies independent of external considerations, even with more flexible exchange rates. Capital inflow surges, for example, can push up monetary aggregates and derail inflation targets. Thus the balancing act between maintaining monetary policy independence and controlling inflation, on the one hand, and attracting foreign funds, on the other, can be difficult.

* Research assistance by Dung Anh Nhan and Thuan-Luyen Le is appreciated. The views presented in this paper are those of the authors alone and do not necessarily reflect those of the Federal Reserve Bank of San Francisco or the Board of Governors of the Federal Reserve System.

The purpose of this study is to review stylized facts of recent episodes of capital flows to East Asian economies and discuss how these flows have affected the conduct of monetary policy. The intent is not to provide a detailed analysis of individual country experiences, but rather to give a broad overview of developments in order to facilitate comparisons and contrasts across countries. Key attention is placed on the comparison of sterilization and exchange rate policies. The paper also examines how the impact of foreign disturbances on domestic interest rates has changed over time and varied across countries.

As is well known, over the long run a central bank cannot control its money supply as well as its exchange rate in the face of highly mobile flows. Our investigation of East Asian experiences indicates that monetary authorities in most countries sought, at least initially, to limit upward pressure on their exchange rates from capital inflow surges by increasing their holdings of foreign reserve assets. To limit the accompanying expansionary pressure on domestic monetary aggregates, sterilization has also been a common policy response.

The relative development of financial markets has influenced the way that sterilization policies were carried out within individual countries. In most countries open market operations involving the sale of government assets or central bank liabilities were utilized. However, several countries effectively compensated for the lack of deep money markets in which to conduct such operations by changing reserve requirements or manipulating deposits held by public sector institutions as monetary instruments.

Nevertheless, despite efforts at sterilization, because of the magnitude of capital inflow surges, foreign reserve accumulations were typically accompanied by increases in monetary base growth and inflation in subsequent years. Persistent capital inflows ultimately necessitated some degree of exchange rate appreciation in most countries. We find that countries that allowed their currencies to appreciate the most tended to have more success in dampening the inflationary effects of capital inflows.

Our examination of capital inflow episodes indicates that foreign financial developments have had significant influence on the conduct of monetary policy in East Asia. This conclusion is supported by a more formal quantitative empirical analysis indicating that U.S. rates have had a significant effect on the interest rates of most countries in the region. The magnitude of this impact has been largest in those countries in which financial liberalization occurred relatively early or where exchange rates have been managed to limit adjustment.

The plan of the paper is as follows. Section II reviews the mechanics and problems of conducting monetary policy in an open economy. Section III provides stylized facts about the magnitude and nature of capital inflows to East Asian countries. Section IV examines the impact of these flows on the conduct of monetary policy during recent focal episodes of capital inflows in these countries. Section V presents vector autoregression results concerning the interaction of foreign and domestic interest rates.

II. Mechanics of Open Economy Monetary Policy Reviewed

In a completely closed economy, changes in monetary policy are transmitted through the economy entirely by changes in the availability of credit, and when permitted, by changes in interest rates. In an open economy, other channels operate as well. With a pegged exchange rate regime and unrestricted international goods flows, but limited capital mobility, monetary restraint tends to improve the current account as falling domestic demand reduces net imports. The resulting increase in net foreign exchange reserve inflows creates an offset to the initial contraction of money. Thus, under a pegged exchange rate, control of credit and money aggregates is difficult since any balance of payments imbalances tend to generate offsetting movements in the foreign exchange reserve component of the money supply.

Relaxation of restrictions on international capital transactions increases capital mobility and sensitivity to foreign disturbances, particularly fluctuations in foreign interest rates and changes in exchange rate expectations. The problem of maintaining a pegged rate and controlling the money supply is exacerbated the greater the degree of international capital mobility. Consider a policy of monetary restraint that raises domestic rates above foreign rates and induces capital inflows. Pegging the exchange rate necessitates intervention and purchase from the private sector of the foreign exchange brought in by the capital inflows. The resulting stimulus to money aggregates offsets the initial credit contraction and dampens the change in domestic interest rates. Thus when exchange rates are pegged and capital mobility is high, the effective control of credit and money is even more severely limited. Moreover, with greater international capital mobility, foreign financial developments become a more important concern to domestic monetary authorities. For example, changes in foreign interest rates can create pressure for the domestic central bank to make matching changes in policy in order to limit adjustment of the exchange rate.

In response to capital inflows, targets for the exchange rate peg and for money growth can be attained simultaneously to the extent that the central bank can sterilize the impact of the inflows. Sterilization of the expansionary

effects of capital inflows on domestic money aggregates that results from foreign exchange intervention is typically accomplished by contraction of central bank credit to the domestic sector. The contraction of domestic credit can be accomplished through a variety of ways, including open market sales of government liabilities, increases in reserve requirements on commercial bank deposits, curtailment of access to rediscount facilities, and the shifting of government deposits from commercial banks to the central bank.

While sterilization is always possible in a technical sense, its effectiveness depends on the nature and persistence of the capital inflows as well as on the cost of reducing domestic credit by the central bank. To the extent that a high proportion of capital inflows is in the form of direct investment and is not intermediated through the domestic banking system, for example, there may be less accompanying expansion in domestic credit. This limits the expansion of money aggregates and the extent of sterilization necessary. If the capital inflows represent a once-and-for-all movement of capital, such as a reflow of funds to the domestic market following a currency realignment, sterilization requires only a change in the level of the money supply target. If, however, capital flows are the result of continuing arbitrage of international market conditions, the sustainability of a policy of sterilization is less clear.

In this case the extent to which the private sector regards domestic and foreign assets as substitutes is an important consideration. When the central bank buys foreign exchange assets to maintain an exchange rate target in response to capital inflows, thereby raising the domestic money supply, it cannot reduce the money supply by selling domestic government bonds if domestic and foreign assets are regarded as perfect substitutes. The reason is that in this case private sector agents will sell foreign assets in their portfolios in order to absorb the domestic bonds; the sales of foreign bonds prolong the capital inflow, forcing the central bank to buy more foreign currency assets. However, in the case of many developing countries, in particular, the existence of country and currency risk premia generally renders domestic and foreign assets less than perfect substitutes.

Sterilization can also have costly effects on the government's fiscal position and on the allocation of credit within the economy. If capital inflows are attracted by high domestic returns, the sterilization of capital inflows by the monetary authorities typically involves buying low-yielding foreign assets and selling high-yielding domestic assets; the interest differential can create a significant financing burden. Credit allocation costs of sterilization can arise if the economic agents acquiring credit externally differ from those that obtain credit directly or indirectly from the central bank. In an economy where credit is rationed and interest rates are

constrained, it may be difficult for firms that obtain loans directly from the central bank to obtain funds from other foreign or domestic sources. Thus, the sterilization of capital inflows may involve a sharp redistribution of credit within the private sector, creating financing difficulties for certain sectors of the economy. Where credit is rationed primarily by interest rates, sterilization is less likely to have these sectoral effects since credit can flow from one sector to another in response to changes in relative interest rates. Another potential cost of sterilization can arise from policies, such as higher reserve requirements, that raise the costs of commercial banking, thereby promoting disintermediation over time as new financial institutions and instruments arise to bypass controls.

An alternative policy to intervening in response to capital inflows is allowing the foreign exchange value of domestic currency to adjust. With greater exchange rate flexibility, control of the money supply and the ability to influence domestic interest rates are improved, as the exchange rate adjusts in response to capital flows. Monetary restraint, for example, creates pressure for the nominal value of domestic currency to appreciate. The appreciation dampens the offsetting effect of tight money on domestic credit by dampening incipient balance of payments surpluses and foreign reserve accumulation. In addition, the adjustment of the exchange rate enhances the effectiveness of the monetary contraction by further curbing demand for domestic output and reducing inflationary pressures.

While more flexible exchange rates lessen concern about the effects of balance of payments imbalances and the control of monetary aggregates, adjustment of the exchange rate involves its own set of costs. Particularly for a small open economy, volatile capital movements may have greater adverse effects on the tradable goods sector and hence the real economy when they affect the exchange rate than when they affect the money supply.

III. International Capital Flows

The experiences of countries in East Asia illustrate the problems of conducting monetary policy in an environment of internationally mobile capital. In this section we provide stylized facts about the nature of capital flows to countries in the region.

The magnitude of international capital flows can be measured, albeit crudely, by the capital transactions of the balance of payments. To the extent that policy changes such as monetary restraint, currency appreciation, or the imposition of capital controls limit incipient inflows, the magnitude of observed capital flows do not fully reflect *ex ante* pressures. Nevertheless, the balance of payments figures capture broad trends.

Chart 1
Capital Inflows and Current Account Deficits
(as per cent of GDP)

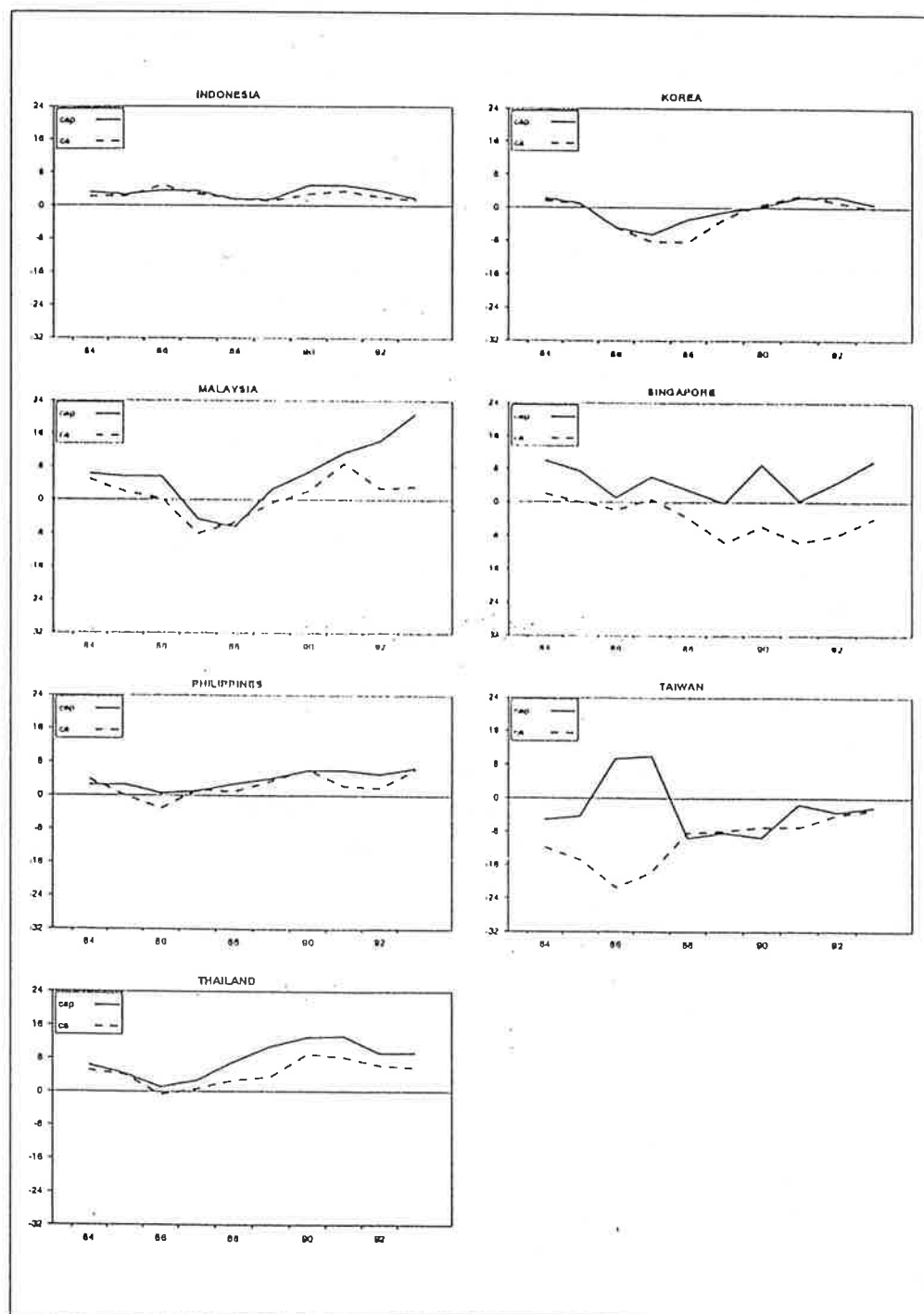


Chart 1 plots annual data on net capital inflows and current account deficits for seven East Asian economies over the years 1984-93. Net capital flows are defined to include balance of payments errors and omissions; the current account includes private and official transfers. To facilitate comparison across economies, the data for each are scaled by GDP.

Observe that the mid and late 1980s witnessed dramatic changes in capital flows for all of these countries. Capital inflows rose significantly in Thailand in 1988, in Malaysia in 1989, and in Indonesia, the Philippines, and Singapore in 1990. At their respective peaks, capital inflows as a percentage of GDP exceeded 13 per cent in Thailand and Malaysia, 10 per cent in Singapore, 6 per cent in the Philippines, and 5 per cent in Indonesia. Korea and Taiwan have had periods of both large capital outflows and capital inflows since the mid-1980s. Korea experienced significant net capital outflows in the period 1986-1989, peaking at 6 per cent of GDP in 1987; followed by net inflows beginning in 1990. Taiwan experienced large capital inflows in 1986 and 1987, amounting to almost 10 per cent of GDP in 1987; net capital outflows of a roughly equal magnitude occurred in 1989-1990.¹

Table 1 disaggregates net capital flows to East Asian countries for particular focal episode periods into direct investment, other financial investment, and errors and omissions, all expressed in per centages of GDP. (Because of data limitations, the discussion of capital flows in this paper does not consider the cases of China nor Hong Kong. However, the impact of foreign interest rates on Hong Kong rates is analyzed in Section V.) Note that direct investment accounted for significantly more than half of the net capital inflows for Malaysia and Singapore.² In the cases of Thailand, Indonesia, the Philippines, Korea, and Taiwan, other financial flows accounted for most of the flows.

The surge of capital inflows can be attributed to both external as well as domestic factors. External factors included currency realignments within the Pacific Basin. After the yen appreciated by over 50 per cent against the U.S.

¹ Calvo, Leiderman, and Reinhart (1992) investigate capital inflows to ten Latin American countries. Their 1993 paper compares inflows in these ten countries with those to eight Asian countries – the seven studied here, plus Sri Lanka. Schudler, Carkovic, Bennett, and Kahn (1993) analyze the capital inflow experiences of six developing countries, including one in the Pacific Basin – Thailand. Bercuson and Koenig (1993) examine capital flow episodes in Thailand, Malaysia, and Indonesia.

² The net capital inflow figures obscure significant levels of gross capital outflows. For example, Singapore is a significant exporter of capital, particularly to Malaysia. As is the case for some of the other NIEs, Singapore has attracted direct investments in capital-intensive industries, while relocating its more labor-intensive industries overseas.

Table 1
Composition of Net Capital Inflows

<i>(in per cent of GDP)</i>					
	Average of Two Prior Years	Year of Capital Inflow Episode ¹			
		0	1	2	3
Indonesia (1990)					
Total Capital Inflows, net	1.6	4.9	5.3	3.8	1.8
Direct Investment, net	0.7	1.0	1.3	1.4	1.4
Other, net	2.1	3.2	3.9	3.4	2.6
Errors and Omissions	-1.2	0.7	0.1	-1.0	-2.2
Malaysia (1989)					
Total Capital Inflows, net	5.5	2.6	6.7	11.5	14.3
Direct Investment, net	1.7	4.4	5.4	8.5	7.7
Other, net	7.0	0.8	1.2	3.5	6.2
Errors and Omissions	0.2	1.0	2.5	0.5	0.4
Philippines (1990)					
Total Capital Inflows, net	3.5	6.0	6.2	5.1	6.6
Direct Investment, net	1.9	1.2	1.2	0.4	1.4
Other, net	0.5	3.5	5.3	5.7	4.7
Errors and Omissions	1.1	1.3	0.3	1.0	0.5
Thailand (1988)					
Total Capital Inflows, net	1.9	7.1	10.9	13.1	13.4
Direct Investment, net	0.5	1.8	2.5	2.9	2.0
Other, net	0.4	4.6	7.1	8.4	10.9
Errors and Omissions	1.0	0.7	1.3	1.8	0.5
Korea (1986)					
Total Capital Inflows, net	1.7	-4.6	-6.4	-2.8	-0.9
Direct Investment, net	0.2	0.3	0.3	0.4	0.2
Other, net	2.6	-4.4	-7.1	-2.8	-1.4
Errors and Omissions	-1.0	-0.6	1.0	-0.3	0.3
Singapore (1990)					
Total Capital Inflows, net	1.5	9.1	0.5	4.8	10.1
Direct Investment, net	10.5	11.0	10.5	12.3	11.0
Other, net	-7.7	1.7	-8.3	-0.9	-6.2
Errors and Omissions	-1.3	-3.6	-1.7	-6.6	-7.1
Taiwan (1986)					
Total Capital Inflows, net	4.7	9.4	10.0	-9.4	-8.3
Direct Investment, net	0.3	0.3	0.0	-2.6	-3.6
Other, net	-5.1	8.9	10.3	-6.8	-4.6
Errors and Omissions	0.1	0.2	-0.3	-0.1	-0.0

¹ First year of episode noted in parentheses next to country name.

Note: Positive values imply capital inflows.

dollar between 1985 and 1988, Japanese investment in Asia shifted in the late 1980s towards lower-cost, labor-intensive locations in Southeast Asia, such as Malaysia and Thailand. The appreciation of the yen also boosted the international competitiveness and current account surpluses of the Newly Industrialized Economies (NIEs), including Korea, Taiwan, Singapore. Subsequent appreciation of the currencies of the NIEs influenced the flow of capital within the region as well.

Capital inflows, particularly portfolio flows, also increased in response to widening interest differentials between domestic and foreign interest rates. Lower short-term interest rates in the United States and recession in the U.S. as well as other industrial countries in the early 1990s helped stimulate capital flows to countries where *ex ante* returns and growth prospects were higher. For example, portfolio and other financial capital inflows picked up significantly in Malaysia in 1991 and 1992.

Domestic factors played a role as well. Improved macroeconomic performance through lower inflation and reductions in public sector deficits attracted capital inflows. For example, Thailand's fiscal balance as a per cent of GDP changed from a deficit of 3.3 per cent in 1986 to a surplus of 2.0 per cent in 1988; Malaysia's fiscal deficit fell from 10.3 per cent to 2.1 per cent of GDP over the same period. Indonesia's fiscal deficit changed from 4.5 per cent of GDP in 1986 to a surplus of 1.4 per cent in 1990.³ Widespread economic reforms in the 1980s in Indonesia, Malaysia, and Thailand, among others also encouraged incoming foreign investment by reducing or eliminating governmental controls over economic activity, privatizing state-owned firms, lowering tariffs and quantitative import barriers, and removing capital controls. For example, Indonesia's deregulation of its banking system in 1988 contributed to capital inflows in subsequent years. Partly as a result of the partial opening of the Korean stock market to foreign investors in 1992, foreign portfolio investment in Korea doubled to 2 per cent of GDP.⁴

³ See Bercuson and Koenig (1993, p. 12).

⁴ Schadler et al (1993) argue that developments in foreign interest rates and growth, while important, are not the dominant causes of recent capital inflows because the timing of changes in these external factors does not coincide precisely with the surges in capital inflows. Output growth peaked in 1988 in Japan and the U.S., but only in 1990 in Germany. The timing of the drop in interest rates also varied: interest rates began to fall in the U.S. in early 1989 and in Japan in mid-1990, but in Germany short-term interest rates rose continuously, while long-term rates fell only slightly in 1991-92. Calvo, Leiderman, and Reinhart (1993), however, argue that domestic reforms alone cannot explain why capital flows occurred in countries that did not undertake reforms, or why they occurred only recently in countries where reforms were introduced well before 1990. They estimate that foreign factors accounted for 30-60 per cent of the variability of real exchange rates and reserves of Latin American countries.

It may also be observed from Chart 1 that net capital inflows (outflows) have been generally associated with current account deficits (surpluses). Along with the increases in their capital inflows in the late 1980s, Thailand, Malaysia, Indonesia, and the Philippines have recorded larger current account deficits. Korea experienced current account surpluses along with its capital outflows in the 1980s and deficits along with its net capital inflows in the 1990s. Taiwan and Singapore represent exceptions to this pattern. Taiwan experienced enormous current account surpluses in the mid-1980s (of the order of 20 per cent of GDP) at the time of its large capital inflows; these surpluses declined significantly as capital outflows increased. Singapore's net capital inflows have also been associated with current account surpluses.

By the logic of balance of payments accounting, the gaps between capital inflows and current account deficits imply an accumulation of official foreign reserve assets.⁵ Table 2 presents the net capital flows, the current account deficit, and official foreign reserve accumulation for the capital flow focal episode periods for each country. Positive values indicate net inflows for capital transactions, a deficit for the current account, and an increase in reserves. (Note that the difference between net capital inflows and the current account deficit equals official foreign reserve increases by construction, since errors and omissions are included in capital flows.)

In Thailand and Malaysia, the gap between capital inflows and the current account deficits that emerged in the late 1980s financed increases of official reserve assets that peaked at over 7 per cent of GDP in Thailand in 1989 and over 11 per cent of GDP in Malaysia in 1992. Reserve accumulation in Indonesia amounted to 2 per cent of GDP in 1990; in the Philippines it peaked at almost 4 per cent of GDP in 1991.⁶ In Korea, with current account surpluses exceeding net capital outflows beginning in 1985, reserve accumulation rose to more than 5 per cent of GDP in 1988. In Taiwan and Singapore, capital inflows and current account surpluses combined to push reserve accumulation above 30 per cent of GDP in the former in 1986 and about 15 per cent of GDP in the latter in 1990.

⁵ Balance of payments accounting implies that the capital account surplus (i.e. net capital inflows) equals the current account deficit (i.e. the excess of domestic expenditures over income) plus the increase in official reserve assets.

⁶ In 1990 the Philippines lost foreign reserves, despite the increase in net capital inflows, because of an offsetting larger increase in its current account deficit. If official borrowing from the IMF is excluded, its loss of reserve assets as a per cent of GDP amounted to 1 per cent of GDP (an amount much greater than the 0.1 per cent figure reported in Table 2).

Table 2
Capital Inflows, Current Account Deficits, and Foreign Reserves

(per cent of GDP)

		Year of Capital Inflow Episode ¹			
	Average of Two Prior Years	0	1	2	3
Indonesia (1990)					
Total Capital Inflows, net	1.6	4.9	5.0	3.8	1.8
Current Account Deficit	1.4	2.8	3.5	2.2	1.4
Official Foreign Reserve Increase	0.2	2.1	1.5	1.6	0.4
Malaysia (1989)					
Total Capital Inflows, net	5.5	2.6	6.7	11.5	14.3
Current Account Deficit	6.6	0.7	2.1	8.9	2.8
Official Foreign Reserve Increase	1.2	3.3	4.6	2.6	11.5
Philippines (1990)					
Total Capital Inflows, net	3.5	6.0	6.2	5.1	6.6
Current Account Deficit	2.2	6.1	2.3	1.9	6.1
Official Foreign Reserve Increase	1.2	0.1	3.9	3.2	0.5
Thailand (1988)					
Total Capital Inflows, net	1.9	7.1	10.9	13.1	13.4
Current Account Deficit	0.1	2.8	3.6	9.1	8.3
Official Foreign Reserve Increase	1.8	4.4	7.3	4.0	5.1
Korea (1986)					
Total Capital Inflows, net	1.7	-4.6	-6.4	-2.8	-0.9
Current Account Deficit	1.3	-4.7	-8.1	-8.1	2.4
Official Foreign Reserve Increase	0.4	0.1	1.7	5.3	1.5
Singapore (1990)					
Total Capital Inflows, net	1.5	9.1	0.5	4.8	10.1
Current Account Deficit	-6.5	-5.7	-9.4	-7.7	-3.7
Official Foreign Reserve Increase	8.0	14.8	9.9	12.5	13.8
Taiwan (1986)					
Total Capital Inflows, net	-4.7	9.4	10.0	-9.4	-8.3
Current Account Deficit	-13.3	-21.5	-17.8	-8.3	-7.8
Official Foreign Reserve Increase	8.6	30.9	27.7	-1.1	-0.5

¹ First year of episode noted in parentheses next to country name.

Note: Capital inflows include errors and omissions.

IV. Monetary Policy Impact

The sharp increases in official reserves in East Asian economies indicates that the capital inflows were met with a heavy degree of foreign exchange intervention by monetary authorities. Thus, in the face of the capital inflow surges, most East Asian economies sought, at least initially, to limit upward pressure on their exchange rates by increasing their holdings of foreign reserve assets. With this goal of moderating exchange rate movements, policymakers faced the choice of whether to allow the reserve accumulation associated with the capital inflows to stimulate demand and growth, or whether to restrain this possibly destabilizing effect by sterilization. Without sterilization, the capital inflows would tend to lower interest rates by raising the net foreign reserve component of the money base, thereby raising the money supply.

Sterilized Intervention

Sterilized intervention to varying degrees has been the most common policy response among East Asian countries to the upward pressure on their monetary aggregates. One indirect indication of sterilization is the extent to which changes in net foreign assets are accompanied by offsetting changes in domestic credit. If net foreign asset increases are offset by declines in net domestic credit by the monetary authorities, the monetary base is unaffected.⁷

Table 3 presents data for the capital flow episodes of each economy identified in Section III on annual money base growth and annual changes in the net foreign asset and domestic credit components of the base, each as a ratio of the previous year's monetary base level. (By construction the two ratios sum to the rate of annual money base growth.)

Observe that in the first year of capital inflow surges, the associated increases in net foreign assets were accompanied by declines in domestic credit in Thailand, Indonesia, Taiwan, and Singapore. Significant declines in domestic credit occurred in Malaysia a year after the onset of its surge in 1989, and in Korea two years after foreign asset reserves began rising in 1986. In the Philippines the capital inflow surge was initially accompanied

⁷ A more formal test involves a regression of the change in domestic credit on the change in net foreign assets, assuming account is taken of the causality problem of whether the decline in domestic credit is the cause of subsequent capital inflows or an offset of previous inflows. Based on his finding of low estimated offset coefficients, Fry (1993) argues that monetary authorities in Indonesia, Korea, Malaysia, the Philippines, Taiwan, and Thailand retained considerable short-term monetary control despite relatively open financial markets and limited exchange rate adjustment. This suggests that these countries were able to sterilize net capital inflows relatively successfully.

Table 3
Contributions to Monetary Base Growth

(in per cent)					
	Average of Two Prior Years	Year of Capital Inflow Episode ¹			
		0	1	2	3
Indonesia (1990)					
Monetary Base	10.8	16.3	3.3	19.6	—
Foreign Reserves ²	−3.0	58.1	62.3	66.0	—
Domestic Credit ²	13.7	−41.8	−59.0	−55.4	—
Malaysia (1989)					
Monetary Base	10.0	28.5	23.7	19.1	12.2
Foreign Reserves ²	11.0	28.6	36.0	18.6	76.4
Domestic Credit ²	−0.8	0.0	12.4	0.5	−64.1
Philippines (1990)					
Monetary Base	27.6	17.7	20.1	13.0	18.9
Foreign Reserves ²	18.6	−33.6	63.7	44.8	42.1
Domestic Credit ²	9.0	51.3	−43.6	−31.8	−23.2
Thailand (1988)					
Monetary Base	16.3	14.9	16.9	18.6	13.3
Foreign Reserves ²	30.4	48.4	74.6	62.5	56.2
Domestic Credit ²	−14.2	−33.6	57.7	−43.9	−43.0
Korea (1986)					
Monetary Base	2.7	16.2	48.9	30.2	31.8
Foreign Reserves ²	6.0	4.3	18.0	81.0	19.5
Domestic Credit ²	−3.3	11.8	30.9	−50.8	12.3
Singapore (1990)					
Monetary Base	14.2	7.2	10.6	10.6	8.4
Foreign Reserves ²	47.8	96.1	65.9	81.6	89.3
Domestic Credit ²	−33.6	−88.9	−55.2	−71.0	−80.9
Taiwan (1986)					
Monetary Base	13.6	29.1	27.5	25.7	32.5
Foreign Reserves ²	64.3	187.8	111.4	−4.6	−19.9
Domestic Credit ²	−50.6	−158.8	−83.9	30.4	52.4

¹ First year of episode noted in parentheses next to country name.

² Change as a per cent of end of previous year's monetary base level.

by a loss of official reserves because of an accompanying large current account deficit; domestic credit was raised to offset increased fiscal surpluses.⁸ When the capital inflows continued in the following two years and foreign reserves rose, the authorities sterilized by reducing domestic assets.

Implementation of Sterilization

The relative development of financial markets influenced the way that sterilization policies were implemented among individual East Asian countries. Most countries sought to limit the serious distortions in their financial markets that would have resulted from the broad use of direct credit controls. However, in many cases, open market sales operations were limited by the absence of marketable government securities in the portfolios of the monetary authorities. As a result, some central banks issued their own liabilities to absorb excess domestic credit.

The Bank of Korea, for example, sterilized a large part of its foreign asset increases beginning in 1987 by absorbing excess liquidity through open market sales of Monetary Stabilization Bonds (MSBs).⁹ Taiwan's Central Bank of China sterilized a large proportion of the increase in foreign reserves by selling liabilities to commercial banks. In Indonesia, policymakers reduced domestic credit in 1990-91 by requiring state-owned enterprises to buy Bank Indonesia certificates (SBIs) in an amount that totalled almost half of the M1 money supply.¹⁰ The Bank of Thailand supplemented open market operations in government bonds by the introduction of sales of its own bonds beginning in 1987. The Philippines Central Bank has conducted open market operations largely in government securities, supplemented by the sale of its own short-term securities.

Sterilization through open market sales were not without costs. In the case of Korea, when the issuance of MSBs peaked in 1989, the total stock outstanding amounted to over 30 per cent of M2. The costs of this issuance grew rapidly as the rate of return on domestic assets rose further above that

⁸ The Philippines' consolidated fiscal deficit rose from 3 per cent of GDP in 1988 to 4.5 per cent in 1989 and 5.5 per cent in 1990; it fell to 2.3 per cent in 1991.

⁹ In 1986, Korea's Ministry of Finance began issuing Foreign Exchange Stabilization Bonds as a means to absorb excess liquidity. Although they are not liabilities of the Bank of Korea they are treated as a liability item of the monetary authorities in official monetary statistics since the funds collected from their sale are used primarily to decrease the net claims of the BOK on the government.

¹⁰ To ease the liquidity effect of this policy, the central bank also simultaneously bought money market instruments (SBPU's).

on foreign currency assets.¹¹ In order to moderate the cost of MSBs, the BOK forced financial institutions to buy the bonds at below market rates of interest.¹²

In other cases, the monetary authorities made pragmatic use of public institutions such as social security funds, state banks, and public enterprises as monetary instruments. Singaporean authorities were able to sterilize the strong net capital inflows of 1990 through a policy of compulsory private saving in the Central Provident Fund combined with ongoing government budget surpluses.¹³ As a result, these inflows did not result in much increase in Singapore's monetary base. In Malaysia the transfer of government and Employee Provident Fund deposits to the central bank played an important role.¹⁴ Indonesia made use of public enterprises' deposits in commercial banks for monetary management. The Central Bank of China also contracted domestic credit by having the postal saving system and the government redeposit funds with the central bank.¹⁵

Money Aggregates Impact

How successfully were the potential effects of net foreign asset changes on the monetary base sterilized? Because sterilization was not always implemented immediately and not always effectively, in a number of countries the reserve accumulations were accompanied by a significant increase in monetary base growth. Korea, Taiwan, Malaysia, and Indonesia were the least successful at limiting increases in monetary base growth. In Korea, annual monetary base growth rose to 16 per cent in 1986, fivefold above the average for 1984 and 1985. It rose to almost 50 per cent in 1987, before slowing in 1988 and 1989, and falling sharply in 1990. In Taiwan, monetary base growth increased sharply in 1986, more than doubling the

¹¹ According to Kwack (1994), interest payments on the outstanding MSB balance amounted to 3.5 per cent of M2 in 1989.

¹² See OECD Economic Survey, Korea (1994, p. 113).

¹³ As Reisen (1993) has pointed out, Singapore reverses the typical sequence of sterilized intervention involving the central bank purchase of foreign exchange followed by an offsetting contraction of central bank credit to the private sector. Because of the combined effects of ongoing budget surpluses and purchases of government securities by the Central Provident Fund, Singapore's money supply has generally tended to contract. Nonsterilized intervention in the foreign exchange market is conducted to offset the liquidity drain and expand the money supply so as to satisfy an exchange rate target.

¹⁴ The Employee Provident Fund is Malaysia's country's largest saver and holds 20 per cent of total domestic financial assets.

¹⁵ Postal savings deposits accounted for about 17 per cent of M2 at the end of 1991; roughly 80 per cent of these deposits are held with the central bank. According to Chiu and Hou (1993, Table 4, p. 190), roughly 30 per cent of the cumulative reduction in domestic credit in 1986-87 was accomplished by redeposits by the Postal Saving System and the Treasury.

average rate of the previous two years, and peaked at more than 30 per cent per annum in 1989, before declining sharply in 1990.¹⁶ In the case of Malaysia, monetary base growth rose from 10 per cent in 1987-1988 to almost 30 per cent in 1989. Bank Negara appeared to be more successful in sterilizing a second surge of net foreign reserve assets in 1992, with the monetary base growth slowing to 12 per cent¹⁷. In Indonesia, monetary base growth rate rose from 11 per cent in 1988-89 to 16 per cent in 1990.

Thailand and Singapore appeared to be somewhat more successful in limiting the impact of foreign reserve accumulation on their monetary base growth. In Thailand, monetary base growth fell slightly in 1988, the first year of its capital inflow surge, and rose only moderately in following years. In Singapore, base growth was significantly lower in 1990 than in previous years, despite an increase in reserve assets almost equal in magnitude to its entire monetary base.

The domestic liquidity effects of reserve asset changes also depend on the money multiplier between the base and broad money. In some countries sterilization was also implemented by affecting the money multiplier between broad money and the monetary base through changes in reserve requirements, liquidity ratios, as well as direct credit constraints that affect the capacity of commercial banks to lend.

Chart 2 plots the ratio of broad money to the monetary base. Observe that the ratio fell discernibly after the onset of the foreign reserve asset surges in Korea, Taiwan, and Malaysia. In fact, these three countries relied heavily on reserve requirements as a monetary policy instrument. Korea more than doubled its commercial bank reserve requirements in 1988.¹⁸ In Malaysia, reserve requirements were raised from 3.5 per cent to 4.5 per cent in May 1989 and to 6.5 per cent in 1990. In Taiwan reserve requirements were raised in 1989.¹⁹ The increase in reserve requirements lowered the money multiplier so that the money aggregates grew less rapidly than reserve money.²⁰

¹⁶ Taiwan's net accumulation of foreign reserves ceased in 1988. However, the rate of monetary base growth remained high, because of open market purchases by the central bank of liabilities sold in sterilization operations in the previous two years.

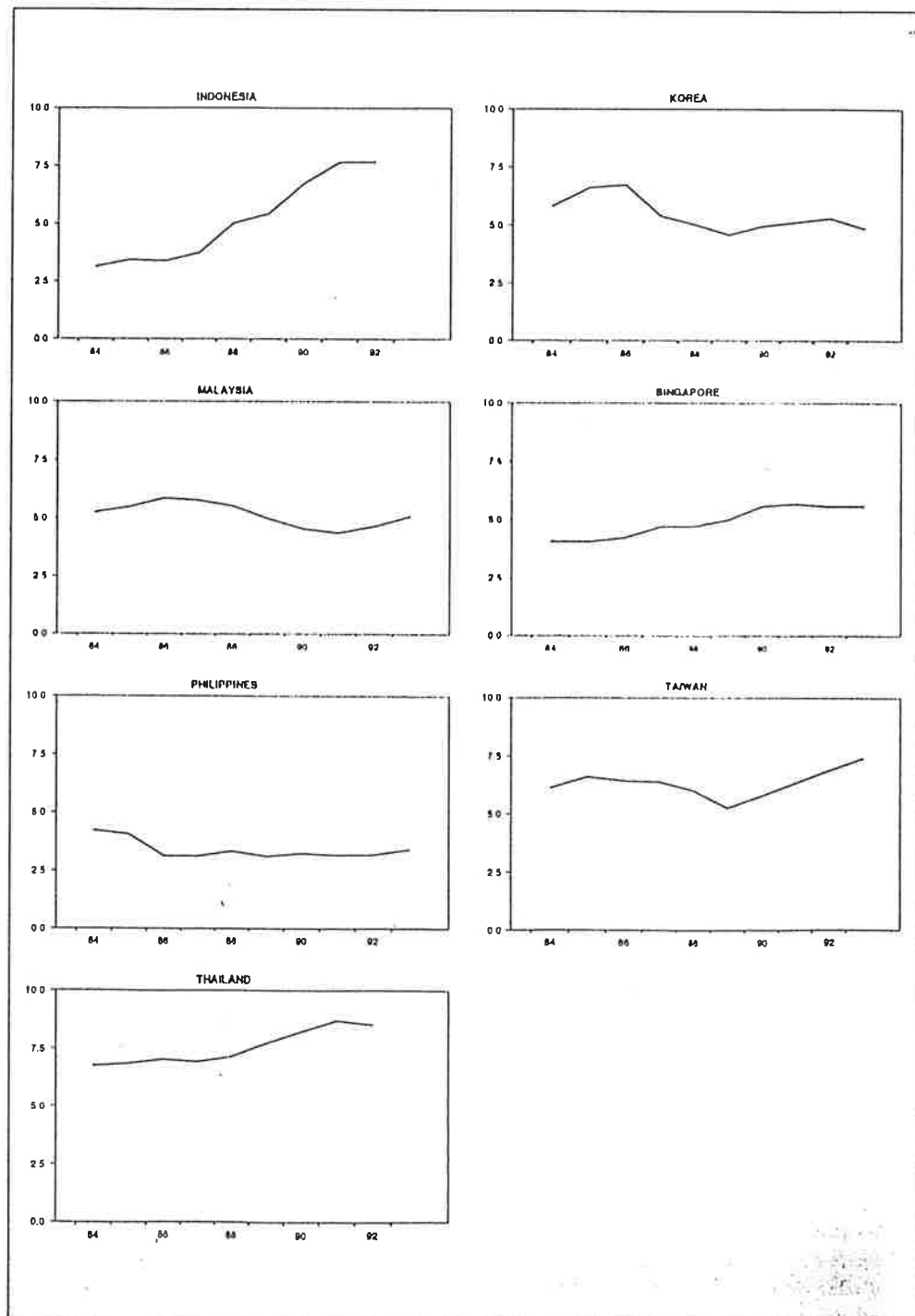
¹⁷ The need for large-scale sterilization of capital inflows that have continued through 1993 and into 1994 remains a significant problem for Malaysian policymakers.

¹⁸ Reserve requirements were raised from 4.5 per cent to 10 per cent. See Lindner (1992).

¹⁹ Taiwan also raised its rediscount rate to 5.5 per cent in April and to 7.75 per cent in August of 1989.

²⁰ In Indonesia reserve requirements on deposit liabilities were lowered significantly in 1988 (from 15 per cent to 2 per cent) as a part of the reform of the banking system. The goal of maintaining the credibility of these reforms presumably limited the use of raising reserve requirements as a monetary policy instrument in later years.

Chart 2
Ratio of Broad Money to Monetary Base
(in per cent)



How have monetary base changes translated into broad money growth? Observe in Table 4 that in association with the greater growth of the monetary base, broad money growth was higher during the capital inflow period than previously in all countries, with the exception of Singapore and the Philippines.²¹ Observe also that, although Korea, Taiwan, and Malaysia had relatively less success in curbing the growth of the monetary base, as noted above, these countries relied more on reducing the money multiplier to limit broad money growth and inflationary pressures. This explains why money growth (and inflation) in Malaysia, for example, was in fact lower than in Thailand despite the former's higher rate of base growth.

Interest Rate Impact

Another gauge of the impact of capital flows on domestic monetary conditions is provided by the behavior of interest rates. Chart 3 plots average short-term nominal and real interest rates for the years 1984-93. Real rates are constructed by subtracting the annual rate of change of consumer prices over the year. Observe that nominal and real interest rates rose strongly during the first several years of the capital surges in Thailand and Malaysia, as monetary policy was tightened.²² In Taiwan and Korea rates rose moderately, possibly because of the lesser degree of interest rate flexibility in their financial systems. Indonesia and the Philippines have generally maintained interest rates at levels well above foreign rates in order to limit the chronic downward pressures on their currencies. Nominal and real interest rates rose sharply in both countries in 1990, the first year of their capital inflow surges, as the governments further tightened monetary policy. In subsequent years, nominal interest rates fell with the deceleration of inflation. In Section V we analyze the behavior of domestic interest rates in East Asian economies more quantitatively.

Capital Controls

Other responses to capital inflows included financial sector reforms, such as easing restrictions on capital outflows as well as the reimposition of

²¹ Broad money is defined as the sum of "money" (currency and demand deposits held by the private sector) and "quasi-money" (time and savings deposits), both as measured by the IMF. It is equivalent to the M2 concept of money. In some countries a broader measure of money than M2 may be a more appropriate focus of attention. In Korea, for example, M2 fell from 70 per cent of M3 in 1980 to under 33 per cent in 1993 (OECD Economic Survey, Korea 1994, p. 111) as a result of the growth of nonbank financial intermediaries.

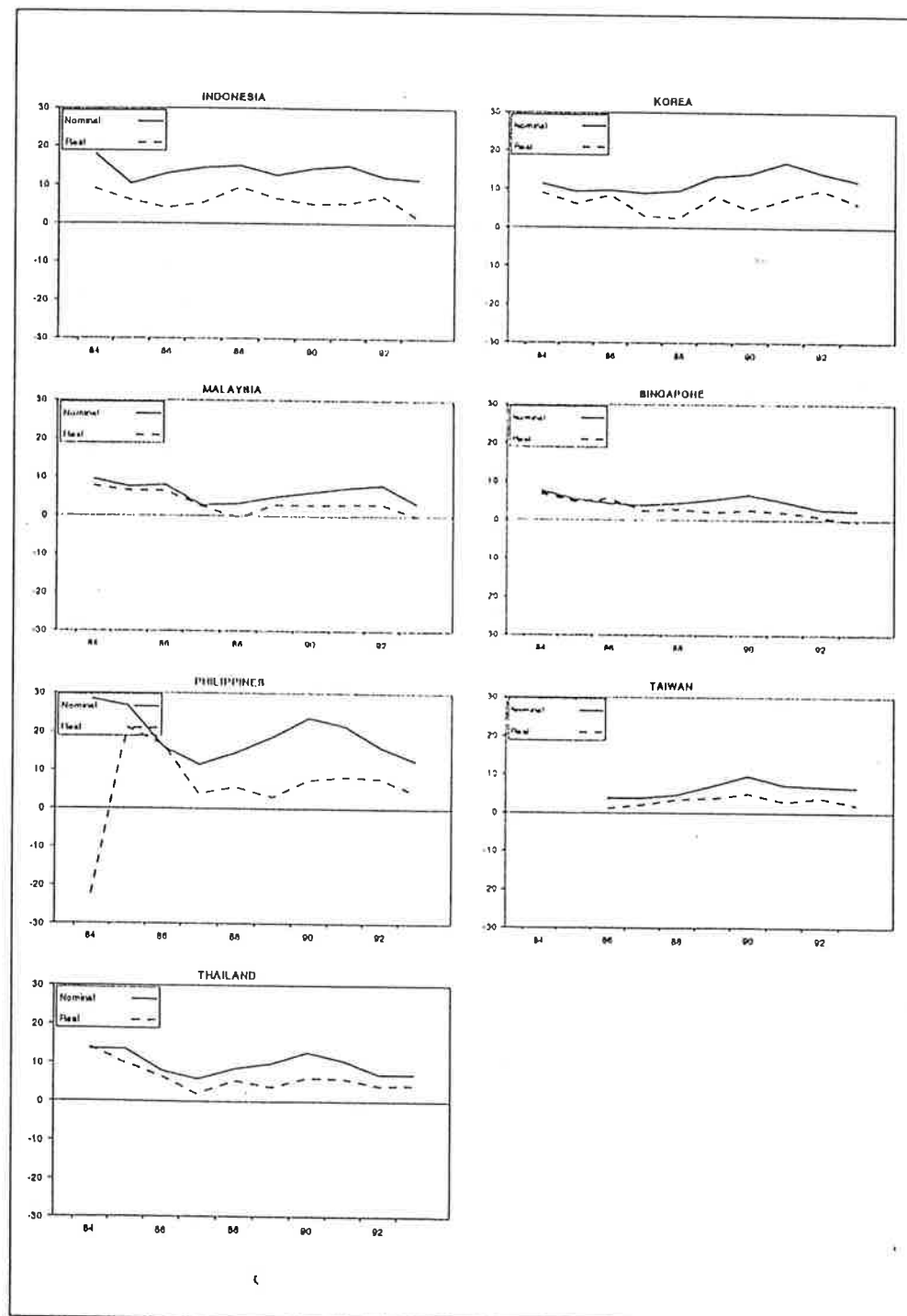
²² In some countries a tightening of domestic credit policies and increase in domestic interest rates occurred just prior or coincident to the initial surge of capital inflows and may have played a role in attracting capital investment.

Table 4
Selected Monetary Indicators

(in per cent)					
		Year of Capital Inflow Episode ¹			
Average of Two Prior Years		0	1	2	3
Indonesia (1990)					
Monetary Base Growth	10.8	16.3	3.3	19.6	-
Broad Money Growth	31.6	44.6	17.5	19.8	-
Currency Appreciation	-0.2	-8.7	-3.8	-1.0	-0.8
Price Inflation	5.8	9.4	9.9	5.0	10.2
Malaysia (1989)					
Monetary Base Growth	10.0	28.5	23.7	19.1	12.2
Broad Money Growth	6.9	16.1	12.8	14.5	19.1
Currency Appreciation	7.1	6.4	3.5	0.4	10.1
Price Inflation	2.0	2.1	3.3	4.2	4.9
Philippines (1990)					
Monetary Base Growth	27.6	17.7	20.1	13.0	18.9
Broad Money Growth	27.4	22.5	17.3	13.6	27.1
Currency Appreciation	0.9	22.1	7.0	8.7	7.1
Price Inflation	12.3	16.2	13.1	8.1	8.4
Thailand (1988)					
Monetary Base Growth	16.3	14.9	16.9	18.6	13.3
Broad Money Growth	16.8	18.2	26.2	26.7	19.8
Currency Appreciation	-9.0	2.3	6.5	-1.2	1.0
Price Inflation	2.6	3.2	6.1	6.6	4.7
Korea (1986)					
Monetary Base Growth	2.7	16.2	48.9	30.2	31.8
Broad Money Growth	11.6	18.4	19.0	21.5	19.8
Currency Appreciation	-4.9	-5.7	-2.2	18.8	9.7
Price Inflation	2.8	1.3	6.0	7.2	5.1
Singapore (1990)					
Monetary Base Growth	14.2	7.2	10.6	10.6	8.4
Broad Money Growth	18.0	20.0	12.4	8.9	8.4
Currency Appreciation	6.4	8.2	6.8	2.7	4.8
Price Inflation	2.4	3.9	2.8	1.8	3.0
Taiwan (1986)					
Monetary Base Growth	13.6	29.1	27.5	25.7	32.5
Broad Money Growth	21.6	26.0	26.4	18.5	16.1
Currency Appreciation	1.5	3.7	13.4	4.4	15.2
Price Inflation	0.2	2.8	1.8	1.1	3.2

¹ First year of episode noted in parentheses next to country name.

Chart 3
Nominal and Real Interest Rates
(in per cent)



controls on capital inflows. For example, Taiwan introduced a major liberalization of controls on capital outflows in July 1987. The outward movement of capital in 1988 offset a large part of the ongoing current account surpluses and dampened the magnitude of reserve accumulation.

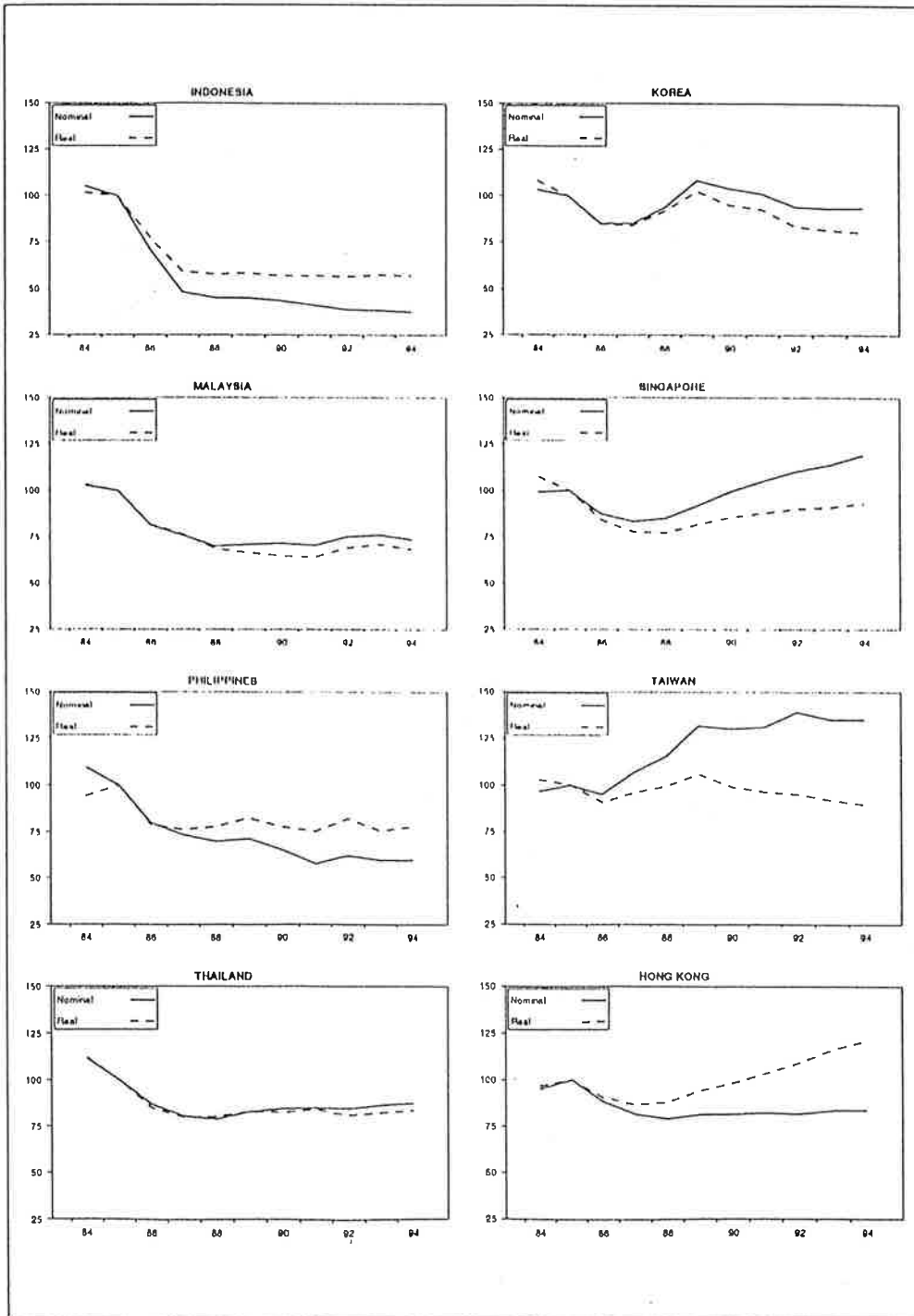
Another response was the imposition of capital controls on inflows. In 1987, Taiwan responded to capital inflows by freezing the foreign liabilities of domestic banks. Partly in an effort to curb the effect of speculation on the exchange rate, Taiwan also restricted foreign access to domestic equity markets. In the face of more recent inflows, in 1994 a ceiling was placed on foreign holdings of listed Taiwanese shares. In the face of continued capital inflows in 1994, Malaysia's Bank Negara limited banks' holdings of foreign funds that are not trade-related or intended for investment in plant, equipment, or inventory stocks. It also took measures that effectively raised reserve requirements on foreign deposits, set a ceiling on the net external liabilities of domestic banks, and prohibited the sale of short-term financial instruments to foreigners.

Exchange Rate Adjustment

In response to the pressures of persistent foreign reserve accumulation, a number of East Asian countries allowed their exchange rates to adjust. Chart 4 shows how the nominal and real effective exchange rates of countries in East Asia behaved through the 1980s and early 1990s. Of particular interest is how exchange rates adjusted at the time of foreign reserve surges. Observe that Taiwan and Korea allowed sharp appreciations in the mid-1980s. Taiwan allowed its exchange rate to appreciate against the dollar in 1986 and 1987; the cumulative change through 1989 was 37 per cent (46 per cent against the dollar). Korea's won did not appreciate significantly until 1988, but between 1986 and 1989 it rose cumulatively 21 per cent (30 per cent against the dollar). These appreciations led to significant reductions in the current account surpluses and the magnitude of foreign asset accumulation in Taiwan and Korea. Singapore allowed its nominal effective exchange rate to appreciate in 1990 and 1991 by 10 per cent (16 per cent against the dollar). Through 1993 it appreciated 22 per cent in effective terms.

In contrast, Malaysia and Thailand limited changes in the values of their respective currencies. Malaysia kept the value of the ringgit broadly stable between 1989 and 1991, before allowing an effective appreciation of 10 per cent (7 per cent against the dollar) in 1992. Thailand's baht was relatively constant, particularly against the dollar. The currencies of Indonesia and the Philippines generally depreciated. In both cases, the capital inflow surges were relatively short-lived.

Chart 4
Nominal and Real Effective Exchange Rate Index
(1985 = 100)



Inflation Consequences

What have been the consequences for inflation during the periods of capital flow surges? In general, those countries that allowed their currencies to appreciate tended to have more success in curtailing the effects of the capital inflows, thus more effectively dampening inflation. Table 5 reports the cumulative appreciation of the nominal effective exchange rate and average inflation levels for the four years following the capital flow surge episodes of each country. Observe that countries with appreciating currencies generally experienced lower inflation. Thus Taiwan, with a cumulative effective appreciation of 37 per cent had an average inflation rate of only 2.2 per cent. Singapore²³ and Korea, with lower magnitudes of appreciation, 22 and 20 per cent, respectively, displayed somewhat higher inflation, 3 per cent for Singapore and 5 per cent for Korea.²⁴ Malaysia and Thailand, each with a moderate amount of appreciation on the order of 10 per cent,

Table 5
Currency Appreciation and Price Inflation During
Capital Inflow Episodes

		(in per cent) ¹
	Cumulative Appreciation ²	Average Price Inflation
Taiwan (1986)	36.6	2.2
Singapore (1990)	22.4	2.9
Korea (1986)	20.7	4.9
Malaysia (1989)	12.7	3.6
Thailand (1988)	8.7	5.2
Philippines (1990)	-13.6	11.4
Indonesia (1990)	-14.3	8.6

¹ Calculations are for four-year period beginning with year noted in parentheses.

² Positive values indicate a rise in the value of domestic currency in terms of an effective basket of foreign currencies.

²³ In Singapore, with a significantly open economy, the authorities use the exchange rate as an intermediate target for stabilizing prices.

²⁴ It should be pointed out that Hong Kong, with a nominal exchange rate that is pegged against the dollar, has experienced significantly higher inflation than the other three NIEs. (Other factors, however, particularly its ongoing integration with China, have played a role.) Analogously, it can be argued that Korea's higher inflation over the period 1990-93, averaging 7 per cent per year, can be attributed to a lesser willingness to allow the won to appreciate than in the 1980s.

experienced inflation rates on the order of 4-5 per cent. At the other extreme, the Philippines and Indonesia, the two countries with the highest nominal rates of currency depreciation, also displayed the highest inflation rates. Thus countries that were reluctant to allow their currencies to appreciate generally maintained a looser monetary policy and experienced greater inflation.

V. Effects of Foreign Interest Rates on Domestic Interest Rates

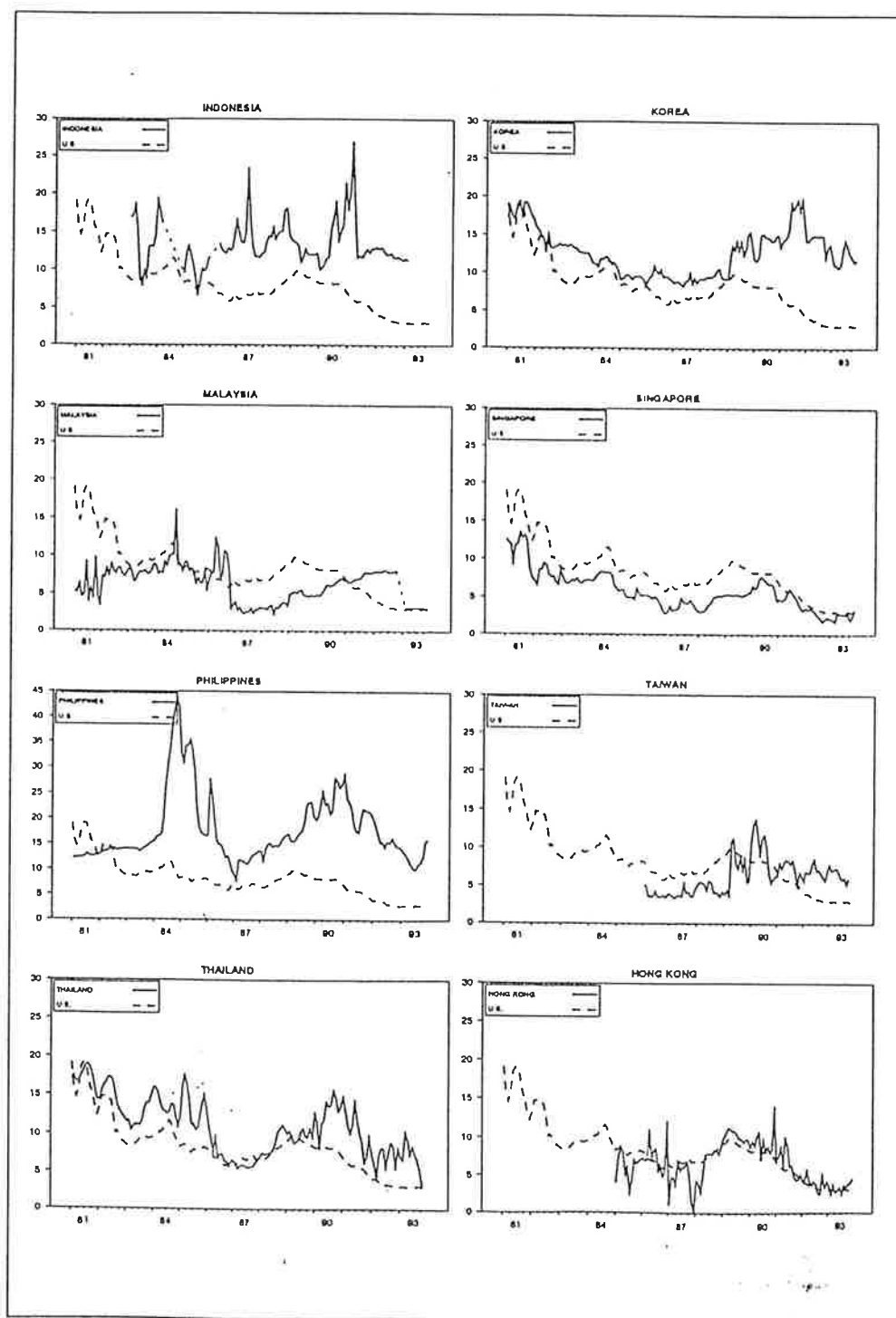
In this section we provide quantitative assessments of the extent of financial openness of Pacific Basin economies and the implications of such openness for domestic monetary control. Analysis of the interaction of domestic and foreign financial factors poses many potential complications, as the appropriate model specification and the availability of data varies across countries. For the purposes of parsimony and ease of comparison, we focus on the relationship between foreign and domestic nominal interest rates using simple two- and three-variable time series models.

Interest rate links reflect both the degree of interdependence of financial markets, and, to the extent exchange rates may be potentially or actually flexible, the expected change of the exchange rate. Gaps between domestic and foreign interest rates may persist if there exist barriers to international capital mobility associated with information costs, government regulations, or default risk and if the exchange rate is expected to change. They may also persist, at least in the short to medium run, if policymakers can control the domestic interest rate while targeting the exchange rate through sterilized intervention.

Chart 5 compares monthly nominal short-term interest rates in Pacific Basin economies with the U.S. Federal Funds rate in the 1980s and 1990s.²³ (The span of each graph varies according to data availability.) Observe that the broad movements of interest rates in Thailand, Hong Kong, and Singapore follow those of the U.S. interest rate relatively closely. In other cases, there are persistent (and at times widening) differences in the direction of movement of the domestic and U.S. rates. It is also apparent that money market rates in Pacific Basin economies tend to be far more volatile than the U.S. rate. This may reflect the thinness of some of the domestic financial markets, as well as the greater impact of exchange rate expectations and country-specific factors in these markets.

²³ The series are money market rates, generally domestic interbank rates, and are described in more detail in the Appendix.

Chart 5
Nominal Domestic and U.S. Interest Rates



One common approach to measuring financial interdependence is by interest rate regressions. Chinn and Frankel (1994), for example, regress domestic nominal interest rates on a U.S. interest rate for a number of Pacific Basin economies over the period 1982-92. Glick and Hutchison (1990) conduct a similar analysis using real interest rates. Both studies find evidence that the U.S. rate has a significant effect for several cases. Such regressions, however, only measure contemporaneous effects of interest rates and neglect possible dynamic relationships. In view of the sterilization policies of East Asian countries discussed in Section IV, it is useful to examine both short-run and long-run relationships between interest rates.

Bivariate Vector Autoregressions

To analyze the contemporaneous and dynamic relationships between interest rates quantitatively, bivariate vector autoregression (VAR) models of monthly U.S. and domestic nominal interest rates were estimated for each economy over the period roughly 1981 – 1993 using six lags. (Shorter data spans were used for Indonesia, Taiwan, and Hong Kong because of data limitations).

As is well known, a time series model may be estimated in levels, first differences, or in error-correction form, depending on whether the data contain unit roots or are cointegrated. However, because tests for unit roots generally have low power, there is no agreement on whether they are a useful guide for model specification. We experimented with all three model specifications indicated above, but ultimately opted for the specification in levels. One reason is that visual inspection of the data suggests some tendency towards mean reversion in levels. Another reason is that for a number of economies, although there is relatively limited co-movement between changes in domestic and foreign interest rates (due to the very high volatility of domestic rates), co-movements in levels appear quite strong over the long run, as, for example, in Thailand, Hong Kong, and Singapore. Estimating the data in levels captures such long-run interest rate relationships. The VAR models are estimated ordering the U.S. equation first. This means that orthogonal interest rate innovations are identified by assuming that any contemporaneous correlation between U.S. and domestic interest rates is attributed to the U.S. rate.

The VAR models are used to address two questions. First, does a rise in U.S. interest rates consistently lead to an increase in domestic interest rates, as might be expected if U.S. interest rate increases reduce the demand for domestic financial assets? This question is addressed by examining the dynamic impulse responses to a U.S. interest rate shock. Second, are the

effects of U.S. interest rates small or large and do they change over the forecast horizon? This question is addressed by looking at the contribution of U.S. interest rates to the forecast error variance of domestic interest rates implied by the model at various horizons.

The Effects of a Rise in U.S. Interest Rates

Chart 6 illustrates the dynamic responses of domestic and U.S. interest rates to a 1 per centage point shock to the U.S. interest rate. The responses have the expected positive sign in all cases, as a shock to the U.S. interest rates tends to raise domestic interest rates in the U.S. as well as in the Asian economies. By construction (because the VAR is estimated in levels), the effects of this shock are temporary.

For seven of the eight economies, a U.S. interest shock tends to have a larger or roughly equal effect on the U.S. interest rate than on the domestic rate, so that the domestic-U.S. differential narrows if the domestic rate is initially above the U.S. rate. (The Philippines is the exception.) Note that the effects of a U.S. interest rate shock are particularly small in Korea. This accords with the fact that access to financial markets in Korea has been liberalized to a much lesser extent than other countries in the region.

To conserve space, the domestic interest rate responses to local interest rate shocks are not illustrated here. However, these responses are also positive, and, with the exception of Singapore, tend to be much larger than the responses to U.S. interest rate shocks.

The Importance of U.S. Interest Rate Shocks

In this section, we assess the relative importance of U.S. interest rates on domestic interest rates in the Pacific Basin by measuring the contribution of innovations in U.S. rates to the variance of the forecast error of domestic interest rates. A large U.S. share means that much of the variation in domestic interest rates can be attributed to innovations in U.S. rates. The first two columns of Table 6 report the variance decomposition of domestic interest rates for the full sample period at 6, 12, and 24-month horizons. A number of interesting results emerge:

First, the economies may be categorized into two distinct groups according to the magnitude of U.S. interest rate effects. In Indonesia, Malaysia, Philippines, Korea and Taiwan, the contribution of the U.S. interest rate is relatively small – 12 per cent or less at a horizon of 24 months. In Hong Kong and Singapore, and to a lesser degree, Thailand, the

Chart 6
Dynamic Responses to U.S. Interest Rate Shock

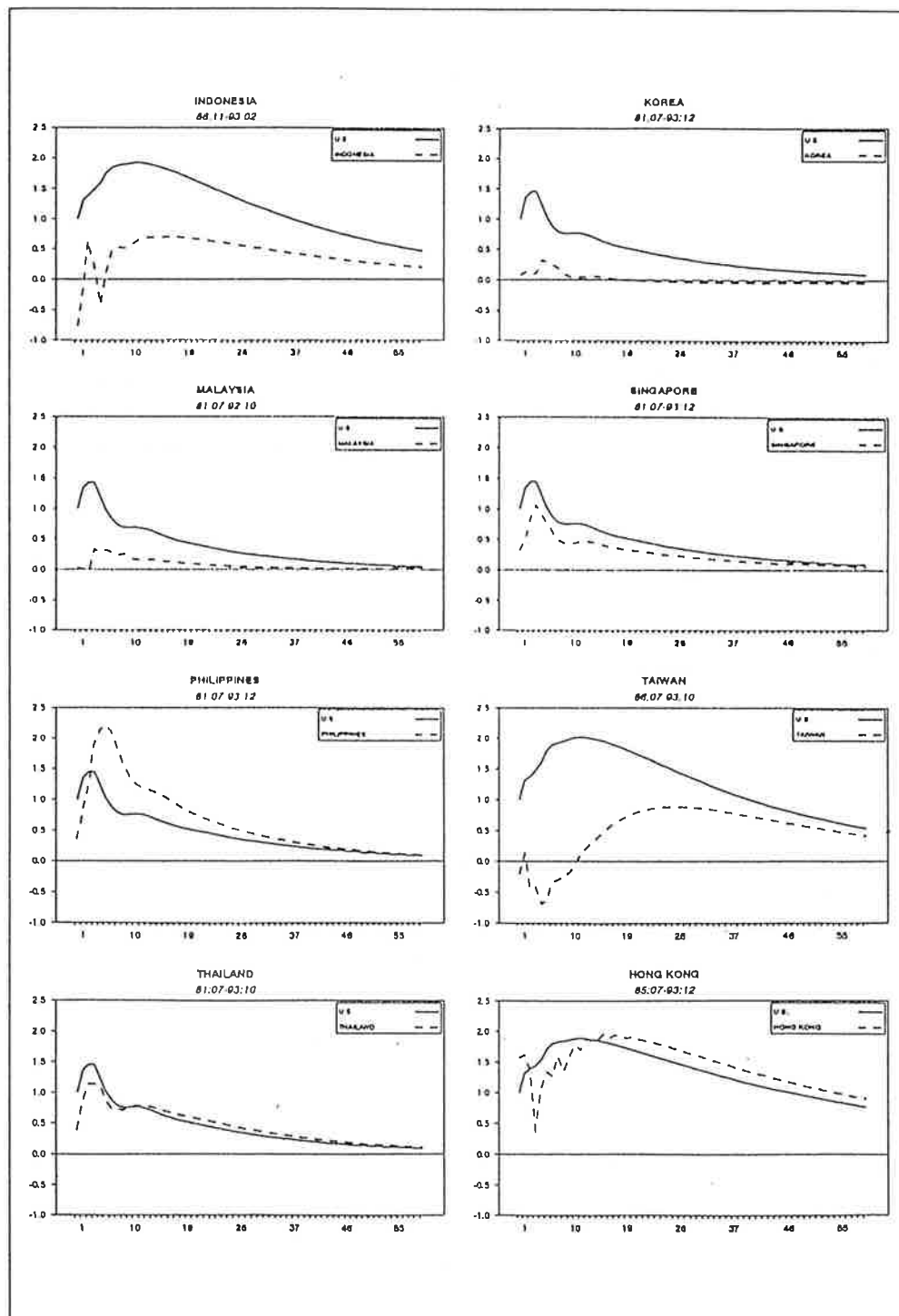


Table 6
Variance Decomposition of Nominal Domestic Interest Rate Levels

(in per cent)

Country/Area ¹	Months	Full sample		Sub-sample	
		U.S. Rate	Domestic Rate	U.S. Rate	Domestic Rate
Indonesia	6	1	99	18	82
Full: 86.11-93.2	12	2	98	21	79
Sub: 89.1-93.2	24	6	94	22	78
Malaysia	6	1	99	21	79
Full: 81.7-92.10	12	2	98	83	17
Sub: 89.1-92.10	24	2	98	89	11
Philippines	6	8	92	4	96
Full: 81.7-93.12	12	11	89	15	85
Sub: 89.1-93.12	24	12	88	38	62
Thailand	6	17	83	3	97
Full: 81.7-93.10	12	22	78	3	97
Sub: 89.1-93.10	24	30	70	39	61
Korea	6	1	99	10	90
Full: 81.7-93.12	12	1	99	13	87
Sub: 89.1-93.12	24	1	99	19	81
Singapore	6	42	58	12	88
Full: 81.7-93.12	12	49	51	17	83
Sub: 89.1-93.12	24	56	44	66	34
Taiwan	6	2	98	4	96
Full: 86.7-93.10	12	2	98	5	95
Sub: 89.1-93.10	24	7	93	10	90
Hong Kong	6	14	86	27	73
Full: 85.7-93.12	12	28	72	53	47
Sub: 89.1-93.12	24	52	48	70	30

¹ The sample range for the full- and sub-sample periods are noted below each country name.

contribution of the U.S. rate is much larger. In this second group, at 2 years the U.S. rate explained 56 per cent in Singapore, 52 per cent in Hong Kong, and 30 per cent in Thailand.

The country groupings roughly conform to our understanding of the rate of financial liberalization and exchange rate policies of these economies. Korea and Taiwan have been insulated from U.S. interest rate shocks by the fact that they liberalized relatively late and to a lesser extent than other countries in the region. In addition, the currencies of both countries appreciated significantly against the dollar in the 1980s.²⁶ While Indonesia has maintained a relatively liberal policy towards capital outflows, historically it has regulated external borrowing. This, and the absence of relatively liquid domestic financial instruments may have weakened the contribution of U.S. rates. The Philippines also has generally restricted foreign borrowing. In the case of Malaysia, the small effect of U.S. interest rates is less easy to explain since its financial markets have been relatively open to international capital flows. The explanation may lie in the role of direct investment and other financial inflows unrelated to U.S. interest rate levels. We pursue this further below when we include Japanese interest rates in the analysis.

The large exposure of Hong Kong and Singapore to U.S. interest shocks may be attributed to the absence of international capital controls, and the fact that these economies have generally limited adjustment of their exchange rates. In Hong Kong's case, its explicit pegging against the dollar since 1983 has compelled it to maintain interest rates at levels consistent with conditions in the United States. While Thailand liberalized relatively late, the large role of the U.S. interest rates may reflect the fact that adjustment of its exchange rate has been relatively limited as well, particularly during the period of the surge of capital inflows in the late 1980s. Between 1988 and 1993 the value of the baht was virtually unchanged against the dollar.

A second interesting result is that the contribution of U.S. rates increases with the length of the horizon. One explanation is that the lower short run impact of U.S. interest rates reflects the efforts of Pacific Basin economies to dampen the effects of capital flows by sterilizing the effects of exchange rate intervention on domestic credit. Efforts to sterilize become less effective over time.

²⁶ Moreno (1994) analyzes more fully how the shift toward greater exchange rate flexibility by Korea and Taiwan in the 1980s reduced their vulnerability to external shocks.

Sub-sample Results

The bivariate model suggests that while the effects of U.S. rates on domestic rates are positive, in some cases they are small. One question that comes to mind is whether the impact of U.S. interest rate shocks has increased in recent years with the increase in U.S. capital flows to the region. To address this question, the VAR models were reestimated over the period 1989 – 1993. In the interest of conserving space, the dynamic responses are not reported, and we focus instead on the variance decomposition results.

The next to last column of Table 6 indicates that in general, the contribution of U.S. interest rate shocks to the variance of domestic interest rates tended to increase after 1989 in all economies. In particular, in Malaysia, the Philippines, and to a lesser extent, Korea, the impact of foreign rates appears to have become larger.

The Importance of Japanese Interest Rates

It can be argued that a two-variable model may be too small to adequately describe the variety of external and domestic shocks that affect domestic interest rates. While the model may plausibly be expanded in several directions, we will limit ourselves to accounting for the impact of Japanese interest rates. Japanese interest rates may have influenced domestic interest rate developments in Pacific Basin economies because in the 1980s there was a sharp increase in Japanese investments in the region, associated with the liberalization of foreign exchange controls, the appreciation of the yen, and the sharp inflation of asset prices in Japan.

In an effort to shed further light on the effects of Japanese interest rates, we estimated a three-variable VAR comprising the U.S. interest rate, the Japanese interest rate, and the domestic interest rate. The Japanese interest rate is placed second in the VAR model but lagged changes of the Japanese interest rate appear in the U.S. interest rate equation. This implies that any contemporaneous correlation between U.S. and Japanese interest rates is assumed to reflect shocks to the U.S. interest rate, but that Japanese interest rates are allowed to affect U.S. interest rates with a lag. Neither the U.S. nor the Japanese interest rates are assumed affected by the interest rates of the other Asian economies.

The variance decomposition results for the three-variable VAR are reported in Table 7. To conserve space, we limit ourselves to the 24-month forecast horizon. It may be noted that the tendency for the contribution of

Table 7
Variance Decomposition of Nominal Domestic Interest Rate Levels
for Three Variable VAR

(shares in per cent, 24-month horizon)

Country/Area ¹	Full sample			Sub-sample		
	U.S. Rate	Japanese Rate	Domestic Rate	U.S. Rate	Japanese Rate	Domestic Rate
Indonesia Full: 86.11-93.2 Sub: 89.1-93.2	8	10	82	26	18	56
Malaysia Full: 81.7-92.10 Sub: 89.1-92.10	7	23	69	45	49	6
Philippines Full: 81.7-93.12 Sub: 89.1-93.12	10	11	79	27	29	43
Thailand Full: 81.7-93.10 Sub: 89.1-93.10	33	22	45	21	37	42
Korea Full: 81.7-93.12 Sub: 89.1-93.12	3	16	81	17	31	52
Singapore Full: 81.7-93.12 Sub: 89.1-93.12	63	5	32	37	16	48
Taiwan Full: 86.7-93.10 Sub: 89.1-93.10	5	11	83	9	12	79
Hong Kong Full: 85.7-93.12 Sub: 89.1-93.12	31	10	59	43	23	34

¹ The sample range for the full- and sub-sample periods are noted below each country name.

foreign shocks to increase in the long-run (observed in the two-variable model) holds true in the present model.

For the full sample period, Singapore, Hong Kong, and Thailand are still the economies apparently most influenced by foreign interest rate shocks. For these three economies, the role of U.S. interest rates is still dominant. Note also that Malaysia now appears to be quite strongly influenced by foreign interest rates, once the Japanese rate is taken into account.

For the sub-sample, the contribution of foreign shocks increases for most economies. Note that the inclusion of the Japanese interest rate suggests that the contribution of foreign shocks is larger in many economies than was indicated by the two-variable model. Also note that the contribution of Japanese rate shocks appears to increase in the sub-sample, relative to the contribution of U.S. rate shocks.

Summary of VAR Results

We may summarize the results of our empirical analyses of nominal interest rate relationships in the Pacific Basin as follows:

First, the impact of U.S. interest rates on domestic rates in East Asian economies is generally positive.

Second, over the full sample period the magnitude of the effect of U.S. interest rates varies in a manner consistent with the characteristics of Pacific Basin economies. In economies where financial liberalization has come relatively late, or exchange rates fluctuate more freely, the effects of U.S. interest rates are small. Conversely, the effects of U.S. interest rates are large in economies where access to domestic financial markets has been relatively open, and the monetary authorities have tended to limit changes in the exchange rate.

Third, the importance of foreign shocks appears to have increased since 1989.

Fourth, Japanese interest rates appear to be important in a number of Asian economies. Their impact has increased, relative to the impact of U.S. rates, since 1989.

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Data Appendix

Tables 1 and 2. Balance of payments data in U.S. dollar terms are from International Monetary Fund, *International Financial Statistics* for all economies except Taiwan. In Table 1, "Total Capital Inflows, net" are defined as the sum of "Direct Investment" (77bad), "Portfolio Investment" (77bad, not shown separately in Table 1), "Other Capital" (77g.d), and "Net Errors and Omissions" (77e.d). In Table 2, "Current Account Deficit" is defined as the negative of the "Current Account" (77a.d). "Official Foreign Reserve Increase" is defined as the difference between "Total Capital Inflows, net" and the "Current Account Deficit". All figures are expressed as a per centage of nominal Gross Domestic Product (99b), converted into U.S. dollars at the average annual exchange rate (rf.zf). For Thailand, the 1993 current account figures were obtained from *Quarterly Bulletin*, Bank of Thailand. Thailand's nominal GDP for 1991, 1992, and 1993 were estimated from figures on real GDP growth rates and consumer price inflation reported in *Consensus Forecasts*. All data for Taiwan are from *Financial Statistics*, Taiwan.

Table 3. Money aggregates data are from International Monetary Fund, *International Financial Statistics* for all economies, except Taiwan. "Monetary Base" is defined as "Reserve Money" (14.zf). "Foreign Reserves" are defined as "Foreign Assets" (11.zf) minus "Foreign Liabilities" (16c). For Singapore and Taiwan, "Foreign Liabilities" are assumed to be zero. "Domestic Credit" is defined as "Monetary Base" less "Foreign Reserves". Figures for Malaysia have been updated from *Quarterly Bulletin*, March-June 1994, Bank Negara Malaysia, Table 14. Data for Taiwan are from *Financial Statistics*, Taiwan. Growth rate figures are constructed by the rate of change from December to December or over the most recent twelve month period.

Tables 4 and 5. Broad money and price data are from International Monetary Fund, *International Financial Statistics* for all economies except Taiwan. "Monetary Base" is defined as in Table 3. "Broad Money" is defined as the sum of "Money" (37.zf) and "QuasiMoney" (35.zf). "Price Inflation" is constructed from "Consumer Prices" (64.zf). For Malaysia, "Broad Money" is measured by "M2" from *Quarterly Bulletin*, March-June 1994, Bank Negara Malaysia, Table 12. All money and price data for Taiwan are from *Financial Statistics*, Taiwan. "Currency Appreciation" is constructed from data provided by Mr. Carl Strong of J.P. Morgan for nominal effective exchange rate indices based on 22 OECD and 23 emerging market currencies. Growth rates are estimated by the rate of change from December to December or over the most recent twelve month period.

Tables 6 and 7. Nominal interest monthly data for the VAR analysis are from International Monetary Fund, *International Financial Statistics*, "Nominal Interest Rate" (60.bzf); from *Financial Statistics*, Taiwan; and for Hong Kong, from DRI @ DRIINTL rmibor@hk.

Chart 1. "Capital Inflows" as defined in Table 1. "Current Account Deficit" as defined in Table 2.

Chart 2. Constructed from data on broad money and monetary base defined in Tables 3 and 4.

Chart 3. Nominal interest and price data are same as in Tables 4 and 6. Real Interest rate is defined as the nominal interest rate for the year minus consumer price inflation over the year (December/December).

Chart 4. Nominal and real effective exchange rate indices from J.P. Morgan, New York.

Chart 5 and 6. Based on interest rate data as described in Tables 6 and 7.

